Scientific note

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Vanilla karenchristianae (Orchidaceae): taxonomic notes and first record in the Brazilian Atlantic Forest

Vanilla karenchristianae (Orchidaceae): notas taxonómicas y primer registro en el Bosque Atlántico brasileño

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Abstract:

Background and Aims: *Vanilla* is one of the well-known genera of the family Orchidaceae due to the ornamental, medicinal and culinary attributes of some of its taxa. The genus is pantropical and has about 120 species mostly found in the Neotropics. The objective of this study was to report the occurrence of *V. karenchristianae* in the Brazilian Atlantic Forest.

Methods: We present a morphological description of *V. karenchristianae* based on the analysis of the newly found population in the state of Bahía, Brazil, and the materials collected in other sites of the country and deposited in herbaria. Also, we provide taxonomical and habitat comments, photographs, and a distribution map of *V. karenchristianae* in Brazil.

Key results: The present record represents the most eastern distribution of *V. karenchristianae* and is approximately 2380 kilometers far from the nearest locality where the species has been recorded. In Brazil, *V. karenchristianae* is currently known from the Amazon and Atlantic Forest phytogeographic domains and from only four localities, including the one added here.

Conclusions: Further recording efforts are necessary to fully understand the geographical distribution and ecological requirements of *V. karenchristianae*.

Key words: Bahía, Brazil, new record, orchids, small population.

Resumen:

Antecedentes y Objetivos: *Vanilla* es uno de los géneros más conocidos de la familia Orchidaceae debido a los atributos ornamentales, medicinales y culinarios de algunos de sus taxones. El género es pantropical y tiene alrededor de 120 especies que se encuentran principalmente en el Neotrópico. El objetivo de este estudio fue informar la ocurrencia de *V. karenchristianae* en el bosque Atlántico brasileño.

Métodos: Presentamos una descripción morfológica de *V. karenchristianae* con base en el análisis de la población recién encontrada en el estado de Bahía, Brasil, y en los materiales recolectados en otros sitios del país y depositados en herbarios. Además, proporcionamos comentarios taxonómicos y de hábitat, fotografías y un mapa de distribución de *V. karenchristianae* en Brasil.

Resultados clave: El presente registro representa la distribución más oriental de *V. karenchristianae* y está aproximadamente a 2380 kilómetros de la localidad más cercana donde se ha registrado la especie. En Brasil, *V. karenchristianae* es actualmente conocida de los dominios fitogeográficos de Amazonía y Mata Atlántica y de solo cuatro localidades, incluida la que se agrega aquí.

Conclusiones: Se necesitan más esfuerzos de registro para comprender completamente la distribución geográfica y los requisitos ecológicos de *V. karenchristianae*.

Palabras clave: Bahía, Brasil, nuevo registro, orquídeas, pequeña población.

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Introduction

Vanilla Plum. ex Mill. is certainly one of the well-known genera of the family Orchidaceae due to the ornamental, medicinal and culinary attributes of some of its taxa (Bythrow, 2005). Recent concerns regarding the narrow genetic diversity of *Vanilla* species have led to the mapping of natural populations and determination of conservation priorities (Bory et al., 2008; Andriamihaja et al., 2020; Chambers et al., 2021). These studies have provided a better understanding of the alpha taxonomy (Karremans et al., 2020; Chiron et al., 2021), pollination strategies and mechanisms (Pansarin, 2022; Watteyn et al., 2023), seed dispersal systems (Pansarin, 2021; Pansarin and Suetsugu, 2022), spatial distribution patterns of populations (Barberena et al., 2021), and they have expanded our knowledge of the geographic range size of many species (e.g., Krahl et al., 2020; Engels and Koch, 2021) and yielded the description of new ones (e.g., Damian and Mitidieri, 2020; Damian et al., 2022).

Vanilla is a pantropical genus with about 120 species mostly found in the Neotropics, especially in Brazil (Karremans et al., 2020). During field studies in the metropolitan region of Salvador in the state of Bahía, Brazil, we found a population of *Vanilla karenchristianae* Karremans & P. Lehm., a recently described species whose distribution and circumscription are progressively becoming better understood (Karremans and Lehmann, 2018; Karremans et al., 2020; Chiron et al., 2021; Flanagan et al., 2022). Here, we report for the first time the occurrence of the species in the Atlantic Forest and in the Northeast region of Brazil and briefly discuss its taxonomic and ecological aspects.

Material and Methods

We present a description of *V. karenchristianae* based on the analysis of the newly found population and complemented with information on materials collected in other sites in Brazil and deposited in herbaria. The specimens were photographed *in situ* with a Motorola Moto Z3 cell phone (Motorola Mobility LLC, Chicago, USA) and a Nikon Coolpix P600 camera (Nikon Corporation, Tokyo, Japan). A voucher was collected and deposited in the ALCB herbarium (acronym according to Thiers, 2023). The Global Biodiversity Information Facility (GBIF, 2023), REFLORA Virtual Herbarium (REFLORA, 2023), and Environmental Information Reference Center (CRIA, 2023) databases were checked in order to locate other material of *V. karenchristianae* and its synonyms. Physical specimens of *V. karenchristianae* deposited in the MG herbarium and photographs of the vouchers from the herbaria CEN, INPA, and RB were examined (acronyms according to Thiers, 2023). A distribution map of *V. karenchristianae* in Brazil was created using the ARC-GIS software v. 10.7.1 (ESRI, 2019).

Results

Taxonomy

Vanilla karenchristianae Karremans & P. Lehm., Orchids (West Palm Beach) 87(4): 305-307. 2018. Fig. 1.

TYPE: COSTA RICA. Puntarenas, Corredores, Canoas, 27.IX.2017, *A. P. Karremans et al. 8087* (holotype: USJ, isotypes: CR, JBL-spirit).

Secondary hemiepiphytic, climbing herb with monopodial growth; stems not thickened in pseudobulbs, subcylindrical, grooved, internodes 7.1-12 cm long; leaves 10-14.1 × 1.8-2.6 cm, dark green, sessile, distributed along the stem, coriaceous, ensiform, margin entire, slightly revolute, apex uncinate; inflorescence ca. 4.8 cm long, racemose, axillary, bearing up to 25 flowers over time, opening singly in succession; floral bracts ca. 0.5 cm long; flowers resupinate; pedicellate ovary 3.3-4.2 cm long; sepals and petals greenish, margin entire, dorsal sepal 3.3-4.7 × 0.7-0.9 cm, oblanceolate, apex acute, lateral sepals 3.3-4.6 × 1.1-1.4 cm, obliquely oblanceolate, apex acute, petals 3.1-4.7 × 0.6-0.85 cm, obliquely oblong to slightly oblanceolate, with a very conspicuous, elevated dorsal keel; lip 3.1-4.7 × 2.6-3.3 cm, white, obscurely trilobed, obovate in outline, with noticeably several longitudinal veins and papillose-verruculose keels, longer towards the apex, margin irregularly crenate, slightly revolute, apex emarginate, penicillate callus 0.8-1 × 0.5-0.6 cm, oblong, closer to the apex than the base, with flabellate, densely lacerate-laciniate scales; column 2.5-3 × 0.5-0.6 cm, ventrally densely pubescent; anther cap and pollen not seen; capsules ca. 9.2 × 1.4 cm, green, oblongoid.

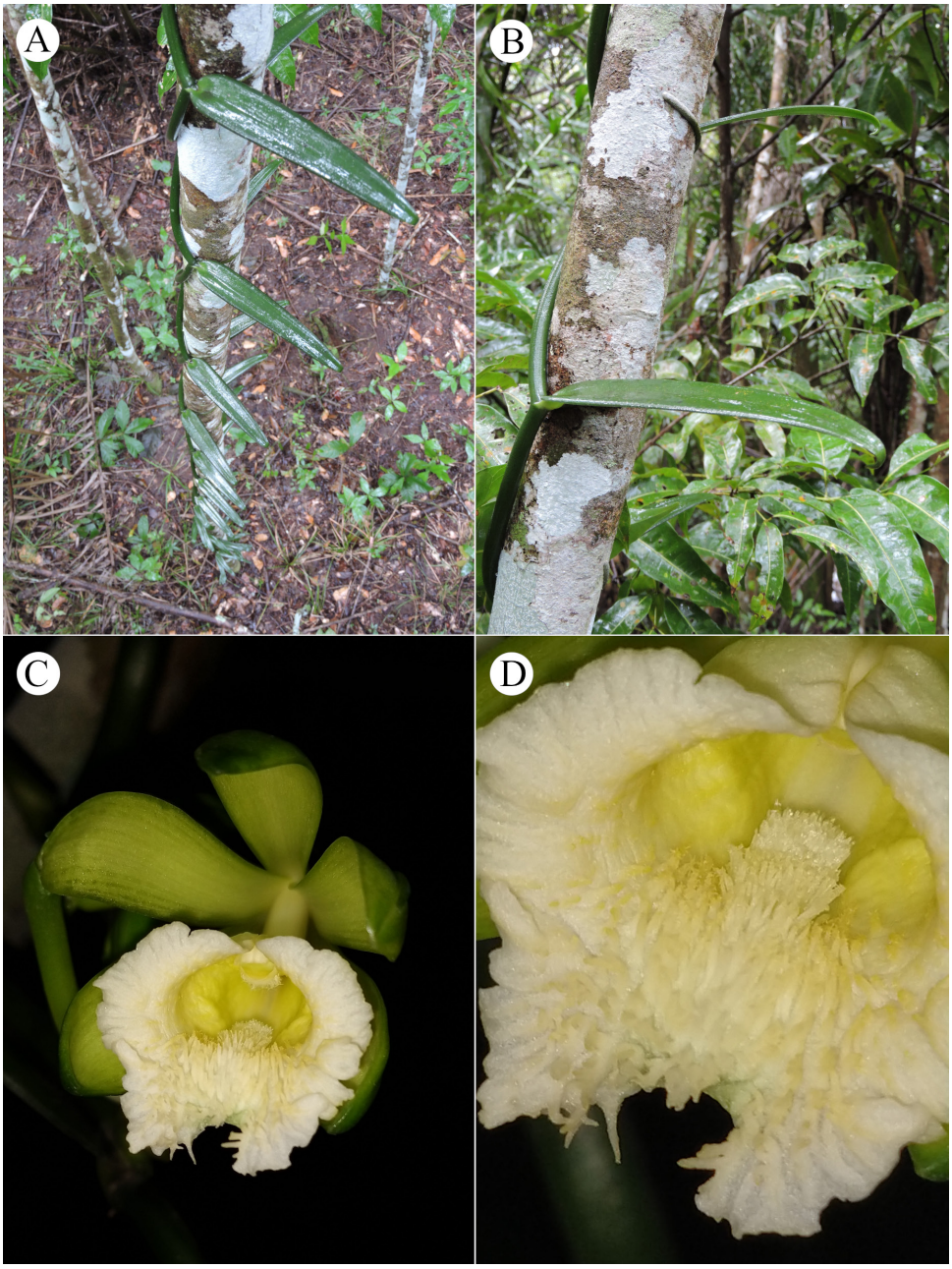

Figure 1: *Vanilla karenchristianae* Karremans & P. Lehm. A. habit; B. leaf details; C. flower; D. lip details, highlighting the penicillate callus (*F.F.V.A. Barberena et al. 421* - ALCB). Photographs by Felipe Fajardo Villela Antolin Barberena (A-B) and Messandro dos Santos Domitilo da Costa (C-D).

Examined material: BRAZIL. Bahía, Candeias, BR-324, km 582, sentido Feira de Santana, 39 m, 12°36'36''S, 38°29'02''W, 20.VII.2022, fl, fr, *F. F. V. A. Barberena 421* (ALCB). Pará, Óbidos, entre Santo Antônio e Solidão, fl, 14.IX.1927, *A. Ducke s.n.* (RB 19446). Rondônia, Porto Velho, Cachoeira de Jirau, 85 m, 9°19'37''S, 64°43'35''W, 22.III.2010, fl. cult. X.2011, *G. Pereira-Silva et al. 15128* (CEN). (Acre or Amazonas), Rio Purús, (3.V.1904), fl. cult. VIII.1906, *J. Huber s.n.* (MG 007302).

Discussion

Vanilla karenchristianae belongs to the *V. planifolia* group (*sensu* Soto Arenas and Cribb, 2010). Chiron et al. (2021) treated *V. karenchristianae* as a synonym of *Vanilla ensifolia* Rolfe, claiming that the morphological differences between them were unclear and could represent intraspecific variability. Nonetheless, Rolfe (1892) described *V. ensifolia* from dried specimens and stated that he analyzed only one flower, with the "imperfect" lip, and he did not provide de-

tails about the disc and the crest. Furthermore, material of *V. ensifolia* is restricted to the type specimens (K000463744 and P00367037), making it impossible to obtain additional floral details. We agree with previous authors (Karremans et al., 2020; Flanagan et al., 2022) that *V. karenchristianae* is a distinct species, easily recognized from other *Vanilla* species by a set of characteristics, namely: the very narrow leaves with a recurved apex, green sepals and petals, carinate petals, white lip with crenate margin (not fimbriate), dense tuft of appendages on the lip, white callus, and ventrally densely pubescent column (Fig. 2). The Brazilian *Vanilla uncinata* Huber ex Hoehne (Hoehne, 1937; 1945), an invalid name historically treated as synonym of *Vanilla odorata* C. Presl (Garay, 1978; Soto Arenas and Cribb, 2010), was recognized as a synonym of *V. karenchristianae* (Karremans et al., 2020).

Vanilla karenchristianae is currently known to occur in Nicaragua, Costa Rica, Colombia, Peru and Brazil at elevations from 30 to 1100 m a. s. l. (Karremans et al., 2020; Flanagan et al., 2022). In Brazil, there are only four records of this species, including the one added here. Previous records consist of specimens collected in the Amazon phytogeographic domain, in the municipalities of Óbidos (state of Pará) and Porto Velho (state of Rondônia), and an uncertain locality along the Púrus River (in the state of Amazonas or Acre; not represented in the Fig. 2). In the state of Pará, the

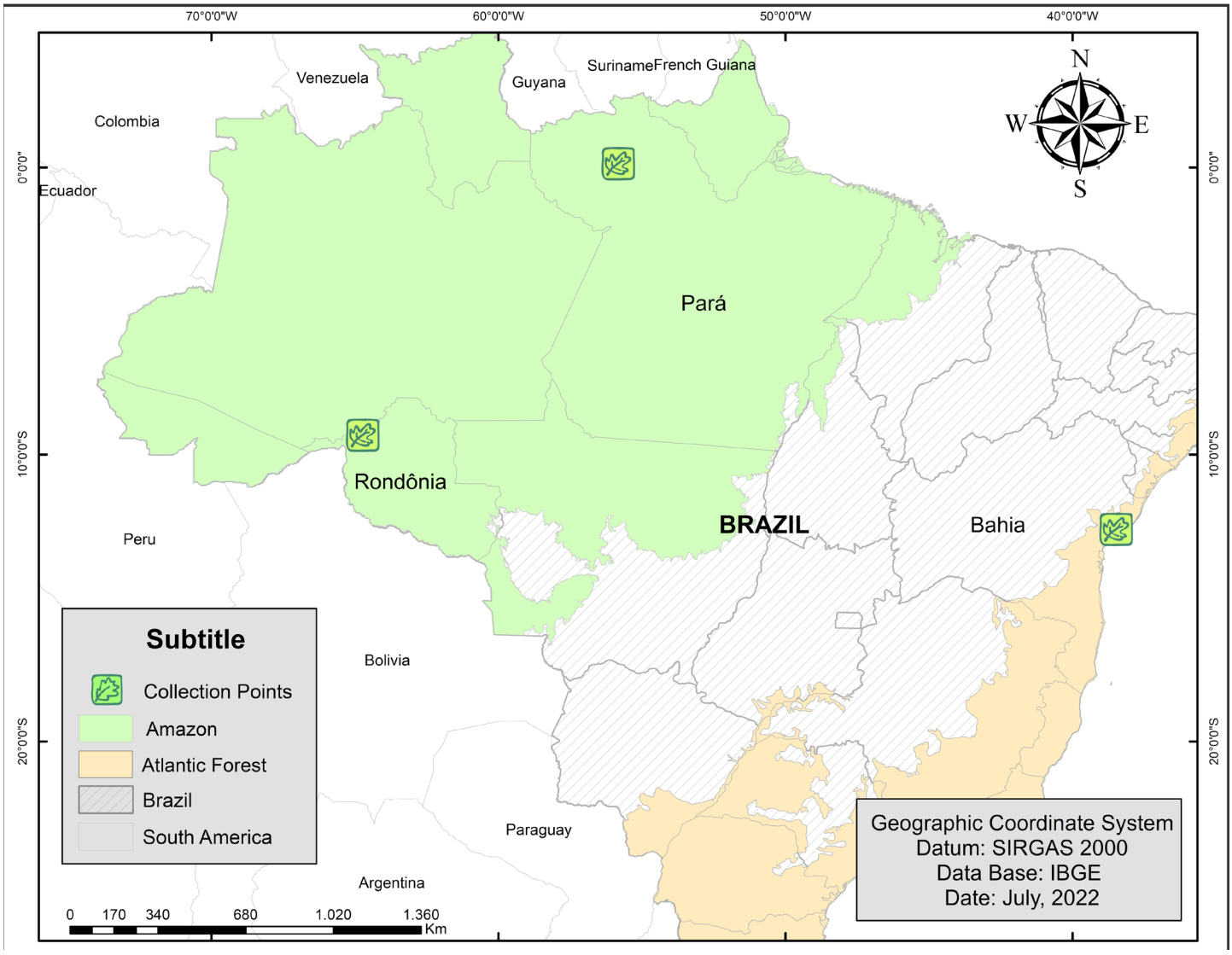

Figure 2: Distribution of *Vanilla karenchristianae* Karremans & P. Lehm. in Brazil. Map prepared by João Victor Paixão de Sousa Ferreira.

species was found in terra firme forest. We revised a specimen from Manaus (*Cabral and Dávila 1866* - INPA 284427), state of Amazonas, previously identified as *V. uncinata* and concluded it corresponds to *Vanilla labellopapillata* A.K. Koch, Fraga, J.U. Santos & Ilk.-Borg. (Koch et al., 2013) instead, a relatively common species in the region, as pointed out by Krahl et al. (2020).

We found ten individuals of *V. karenchristianae* growing on trees very close to a marshy area in a particular rural property of one of the authors (MSDC) in the municipality Candeias in the metropolitan region of Salvador, state of Bahía. The locality is nearby the federal highway BR-324, on the stretch that connects the municipalities of Salvador and Feira de Santana, both in the state of Bahía. Specimens were found growing at about 40 m elevation. Flowers and fruits of *V. karenchristianae* have been seen in July at this site. The vegetation at the collection site consists of an Atlantic Forest fragment that has been regenerating for 23 years. In the surroundings, there are only sparse forest fragments within unfavorable matrices that are not legally protected, which gives an idea of the threats to which the species may be locally exposed.

Our discovery is also relevant from a biogeographic point of view. The present record represents the most eastern distribution of *V. karenchristianae* and is located approximately 2380 km away from the nearest locality where the species has been recorded (Óbidos, Pará). This distance is greater than the territorial extension of Central America and five-fold greater than the territorial extension of Costa Rica. We thus reinforce that *V. karenchristianae* is an infrequent species with a wide geographic distribution like most species of the genus, as proposed by Karremans et al. (2020), and is not a locally restricted and highly threatened species on a global scale, as initially thought (Karremans and Lehmann, 2018).

However, as many other *Vanilla* species (Flanagan and Mosquera-Espinosa, 2016), *V. karenchristianae* forms small populations and seems to occur mainly in humid forests. In Brazil, it is currently known only from the Amazon and Atlantic Forest phytogeographic domains and has been recorded from just four localities. Further recording efforts are necessary to fully understand the geographical distribution and ecological requirements of *V. karenchristianae*.

Author contributions

All authors contributed to the investigation and data curation. FFVAB wrote the manuscript in consultation with DLLC, ITFB and MSDC. All authors had the opportunity to read and approve the final manuscript.

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Literature cited

Andriamihaja, C. F., A. V. Ramarosandratana, M. Grisoni, V. Jeannoda and P. Besse. 2020. The leafless *Vanilla* species-complex from the South-West Indian Ocean Region: a taxonomic puzzle and a model for orchid evolution and conservation research. Diversity 12(12): 443. DOI: https://doi.org/10.3390/d12120443

Barberena, F. F. V. A., E. López Hermoso and M. A. José de Oliveira. 2021. Distribución espacial de *Vanilla bahiana* (Orchidaceae) en dos fitofisonomías de restinga. ¿El patrón espacial varía? Collectanea Botánica: 40: e001. DOI: https://doi.org/10.3989/collectbot.2021.v40.001

Bory, S., M. Grisoni, M-F. Duval and P. Besse. 2008. Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources and Crop Evolution 55: 551-571. DOI: https://doi.org/10.1007/s10722-007-9260-3

Bythrow, J. D. 2005. Vanilla as a Medicinal Plant. Seminars in Integrative Medicine 3(4): 129-131. DOI: https://doi.org/10.1016/j.sigm.2006.03.001

Chambers, A., A. Cibrián-Jaramillo, A. P. Karremans, D. Moreno Martinez, J. Hernandez-Hernandez, M. Brym, M. F. R. Resende Jr., R. Moloney, S. N. Sierra, T. Hasing, Y. A. Alomia, Y. Hu and Vanilla Genotyping Consortium. 2021. Genotyping-By-Sequencing diversity analysis of international *Vanilla* collections uncovers hidden diversity and enables plant improvement. Plant Science 311: 111019. DOI: https://doi.org/10.1016/j.plantsci.2021.111019

Chiron, G. R., A. Sambin and A. H. Krahl. 2021. Taxonomic notes on *Vanilla odorata*, *Vanilla fimbriata* and related species (Orchidaceae). Richardiana 5: 76-115.

CRIA. 2023. Centro de Referência em Informação Ambiental. *Vanilla*. https://specieslink.net/search/ (consulted, March 2023).

Damian, A. and N. Mitidieri. 2020. Living in the clouds: A new high-elevation species of *Vanilla* (Orchidaceae, Vanilloideae) from Peru. Phytotaxa 451(2): 154-160. DOI: https://doi.org/10.11646/phytotaxa.451.2.5

Damian, A., H. X. Garzón, L. Baquero, M. M. Jiménez, L. Vélez-Abarca, G. A. Iturralde, N. Mitidieri, S. Olortegui and K. M. Cameron. 2022. *Vanilla andina* (Vanilloideae, Orchidaceae), a new species of the membranaceous-leaved group from Peru and Ecuador. Phytotaxa 552(1): 63-72. DOI: https://doi.org/10.11646/phytotaxa.552.1.5

Engels, M. E. and A. K. Koch. 2021. *Vanilla ribeiroi* Hoehne (Orchidaceae: Vanilloideae): notes on taxonomy and geographical distribution. Phytotaxa 490(1): 99-106. DOI: https://doi.org/10.11646/phytotaxa.490.1.9

ESRI. 2019. ArcGIS Desktop and Spatial Analyst Extension: Release Ver. 10.7.1. Environmental Systems Research Institute. Redlands, USA.

Flanagan, N. S. and A. T. Mosquera-Espinosa. 2016. An integrated strategy for the conservation and sustainable use of native *Vanilla* species in Colombia. Lankesteriana 16(2): 201-218. DOI: https://doi.org/10.15517/lank.v16i2.26007

Flanagan, N. S., A. Navia-Samboni, E. N. González-Pérez and H. Mendieta-Matallana. 2022. Distribution and conservation of vanilla crop wild relatives: the value of local community engagement for biodiversity research. Neotropical Biology and Conservation 17(3): 205-227. DOI: https://doi.org/10.3897/neotropical.17.e86792

Garay, L. A. 1978. Orchidaceae (Cypripedioideae, Orchidoideae, Neottioideae). In: Harling, G. W. and B. B. Sparre (eds.). Flora of Ecuador, Vol. 9. University of Gothenburg & Swedish Museum of Natural History. Gothenburg & Stockholm, Sweden. Pp. 1-305.

GBIF. 2023. Global Biodiversity Information Facility Occurrence Download. GBIF.org. Copenhagen, Denmark. DOI: https://doi.org/10.15468/dl.4ajgtp

Hoehne, F. C. 1937. Orchidaceas do herbário geral do Museu Goeldi, Belém do Pará, Vol. 8. Archivos do Instituto Biologico (São Paulo). São Paulo, Brasil. 269 pp.

Hoehne, F. C. 1945. Orchidaceae. In: Hoehne, F. C. (ed.). Flora Brasilica, Vol. 12, part. 2. Secretaria da Agricultura, Indústria e Comércio de São Paulo. São Paulo, Brasil. Pp. 1-209.

Karremans, A. P. and C. Lehmann. 2018. A highly threatened new species of *Vanilla* from Costa Rica. Lindleyana 87: 304-307.

Karremans, A. P., I. F. Chinchilla, G. Rojas-Alvarado, M. Cedeño-Fonseca, A. Damian and G. Léotard. 2020. A reappraisal of Neotropical *Vanilla*, with a note on taxonomic inflation and the importance of alpha taxonomy in biological studies. Lankesteriana 20(3): 395-497. DOI: https://doi.org/10.15517/lank.v20i3.45203

Koch, A. K., C. N. de Fraga, J. U. M. Santos and A. L. Ilkiu-Borges. 2013. Taxonomic notes on *Vanilla* (Orchidaceae) in the Brazilian Amazon, and the description of a new species. Systematic Botany 38(4): 975-981. DOI: https://doi.org/10.1600/036364413X674706

Krahl, D. R. P., A. H. Krahl, G. Chiron and M. H. Terra-Araújo. 2020. First record of *Vanilla labellopapillata* (Orchidaceae: Vanilloideae) in the state of Amazonas, Brazil. Acta Amazonica 50(3): 260-262. DOI: https://doi.org/10.1590/1809-4392202001164

Pansarin, E. R. 2021. Unravelling the enigma of seed dispersal in *Vanilla*. Plant Biology 23(6): 974-980. DOI: https://doi.org/10.1111/plb.13331

Pansarin, E. R. 2022. *Vanilla* flowers: much more than food-deception. Botanical Journal of the Linnean Society 198(1): 57-73. DOI: https://doi.org/10.1093/botlinnean/boab046

Pansarin, E. R. and K. Suetsugu. 2022. Mammal-mediated seed dispersal in *Vanilla*: Its rewards and clues to the evolution of fleshy fruits in orchids. Ecology 103(7): e3701. DOI: https://doi.org/10.1002/ecy.3701

REFLORA. 2023. Reflora - Herbário Virtual. *Vanilla*. https://reflora.jbrj.gov.br/reflora/herbarioVirtual/ (consulted, March 2023).

Rolfe, R. A. 1892. CCXLVIII - New orchids: decade 2. Bulletin of Miscellaneous Information, Royal Gardens, Kew 65/66: 137-141. DOI: https://doi.org/10.2307/4102471

Soto Arenas, M. A. and P. Cribb. 2010. A new infrageneric classification and synopsis of the genus *Vanilla* Plum. ex Mill. (Orchidaceae: Vanillinae). Lankesteriana 9(3): 355-398. DOI: https://doi.org/10.15517/lank.v0i0.12071

Thiers, B. 2023. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. https://sweetgum.nybg.org/science/ih/ (consulted March, 2023).

Watteyn, C., D. Scaccabarozzi, B. Muys, B. Reubens, J. D. Ackerman, M. F. Otárola, M. F. G. Amador and A. P. Karremans. 2023. Sweet as *Vanilla hartii*: Evidence for a nectar-rewarding pollination mechanism in *Vanilla* (Orchidaceae) flowers. Flora 303: 152294. DOI: https://doi.org/10.1016/j.flora.2023.152294